

## Military Logic Products

## Quad Two-Input NAND Gates

## Product Specification

## FUNCTION TABLE

INPUTS		OUTPUT
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

H = HIGH voltage level

L = Low voltage level

## ORDERING INFORMATION

DESCRIPTION	PIN CONFIGURATION	ORDER CODE
Ceramic DIP	Figure A	5400/BCA, 54LS00/BCA, 54S00/BCA
Ceramic Flat Pack	Figure A	54LS00/BDA, 54S00/BDA
	Figure B	5400/BDA
Ceramic LLCC	See Note	54LS00/B2A, 54S00/B2A

## INPUT AND OUTPUT LOADING AND FAN-OUT TABLE

PINS	DESCRIPTION	54	54S	54LS
A, B	Inputs	1UL	1SUL	1LSUL
Y	Output	10UL	10SUL	10LSUL

NOTE: Where a 54 Unit Load (UL) is understood to be  $40\mu\text{A } I_{\text{IH}}$  and  $-1.6\text{mA } I_{\text{IL}}$ , a 54S Unit Load (SUL) is  $50\mu\text{A } I_{\text{IH}}$  and  $-2.0\text{mA } I_{\text{IL}}$ , and a 54LS Unit Load (LSUL) is  $20\mu\text{A } I_{\text{IH}}$  and  $-0.4\text{mA } I_{\text{IL}}$ .

## PIN CONFIGURATION

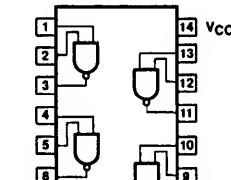


Figure A

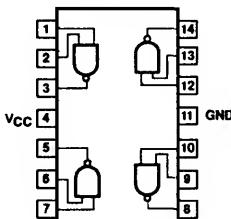
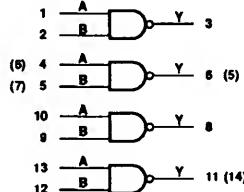


Figure B

For LLCC pin assignments, see JEDEC Standard No. 2

## LOGIC SYMBOL



( ) = Flat Pack Figure B

For LLCC pin assignments, see JEDEC Standard No. 2

## Gates

5400, 54LS00, 54S00

## ABSOLUTE MAXIMUM RATINGS Over operating free-air temperature range unless otherwise noted

SYMBOL	PARAMETER	54			54LS			54S			UNIT
		Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
$V_{CC}$	Supply voltage			7.0			7.0		7.0		V
$V_I$	Input voltage range			-0.5 to +5.5			-0.5 to +7.0		-0.5 to +7.0		V
$I_I$	Input current range			-30 to +5			-30 to +1		-30 to +5		mA
$V_O$	Voltage applied to output in High output state range			-0.5 to $+V_{CC}$			-0.5 to $+V_{CC}$		-0.5 to $+V_{CC}$		V
$T_{STG}$	Storage temperature range							-65 to +150			°C

## RECOMMENDED OPERATING CONDITIONS

SYMBOL	PARAMETER	54			54LS			54S			UNIT
		Min	Nom	Max	Min	Nom	Max	Min	Nom	Max	
$V_{CC}$	Supply voltage	4.5	5.0	5.5	4.5	5.0	5.5	4.5	5.0	5.5	V
$V_{IH}$	High-level input voltage	2.0			2.0			2.0			V
$V_{IL}$	Low-level input voltage			+0.8			+0.7			+0.8	V
$I_{IK}$	Input clamp current			-12			-18			-18	mA
$I_{OH}$	High-level output current			-400			-400			-1000	μA
$I_{OL}$	Low-level output current			16			4			20	mA
$T_A$	Operating free-air temperature range	-55		+125	-55		+125	-55		+125	°C

## DC ELECTRICAL CHARACTERISTICS Over recommended operating free-air temperature range unless otherwise noted

SYMBOL	PARAMETER	TEST CONDITIONS <sup>1</sup>		5400			54LS00			54S00			UNIT
		Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	Max	Min	Typ <sup>2</sup>	
$V_{OH}$	High-level output voltage	$V_{CC} = \text{Min}$ , $V_{IH} = \text{Min}$ , $V_{IL} = \text{Max}$ , $I_{OH} = \text{Max}$	2.4	3.4		2.5	3.4		2.5	3.4			V
$V_{OL}$	Low-level output voltage	$V_{CC} = \text{Min}$ , $V_{IH} = \text{Min}$ , $I_{OL} = \text{Max}$		0.2	0.4		0.25	0.4			0.5		V
$V_{IK}$	Input clamp voltage	$V_{CC} = \text{Min}$ , $I_I = I_{IK}$			-1.5			-1.5			-1.2		V
$I_{IH2}$	Input current at maximum input voltage	$V_{CC} = \text{Max}$	$V_I = 5.5V$		1.0						1.0		mA
			$V_I = 7.0V$					0.1					mA
$I_{IH1}$	High-level input current	$V_{CC} = \text{Max}$	$V_I = 2.4V$		40								μA
			$V_I = 2.7V$					20			50		μA
$I_{IL}$	Low-level input current	$V_{CC} = \text{Max}$	$V_I = 0.4V$		-1.6			-0.4					mA
			$V_I = 0.5V$								-2.0		mA
$I_{OS}$	Short-circuit output current <sup>3</sup>	$V_{CC} = \text{Max}$		-20		-55	-20		-100	-40		-110	mA
$I_{CC}$	Supply current (total)	$V_{CC} = \text{Max}$	$I_{CCH}$ Outputs High		4	8		0.8	1.6		10	16	mA
			$I_{CCL}$ Outputs Low		12	22		2.4	4.4		20	36	mA

## Gates

5400, 54LS00, 54S00

AC ELECTRICAL CHARACTERISTICS  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ 

SYMBOL	PARAMETER	TEST CONDITIONS	54 <sup>4</sup>		54LS		54S		UNIT	
			$C_L = 15\text{pF}$		$C_L = 15\text{pF}$		$C_L = 15\text{pF}$			
			Min	Max	Min	Max	Min	Max		
$t_{PLH}$ $t_{PHL}$	Propagation delay	Waveform 1		22 15		15 15		4.5 5.0	ns ns	

AC ELECTRICAL CHARACTERISTICS  $T_A = 25^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}$ 

SYMBOL	PARAMETER	TEST CONDITIONS	54		54LS <sup>4</sup>		54S <sup>4</sup>		UNIT	
			$C_L = 50\text{pF}$		$C_L = 50\text{pF}$		$C_L = 50\text{pF}$			
			Min	Max	Min	Max	Min	Max		
$t_{PLH}$ $t_{PHL}$	Propagation delay	Waveform 1		26 19		20 20		7.0 7.5	ns ns	

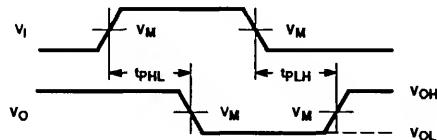
AC ELECTRICAL CHARACTERISTICS  $T_A = -55^\circ\text{C}$  and  $+125^\circ\text{C}$ ,  $V_{CC} = 5.0\text{V}^4$ 

SYMBOL	PARAMETER	TEST CONDITIONS	54		54LS		54S		UNIT	
			$C_L = 50\text{pF}$		$C_L = 50\text{pF}$		$C_L = 50\text{pF}$			
			Min	Max	Min	Max	Min	Max		
$t_{PLH}$ $t_{PHL}$	Propagation delay	Waveform 1		34 25		26 26		9 9	ns ns	

## NOTES:

1. For conditions shown as Min or Max, use the appropriate value specified under recommended operating conditions for the applicable type and function table operating mode.
2. All typical values are at  $V_{CC} = 5\text{V}$ ,  $T_A = 25^\circ\text{C}$ .
3. Not more than one output should be shorted at a time, and duration of the short should not exceed one second.
4. These parameters are guaranteed, but not tested.

## AC WAVEFORM



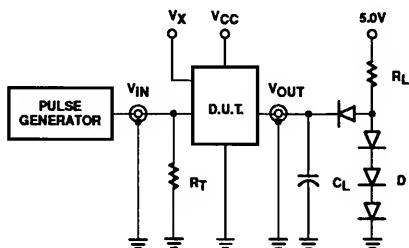
Waveform 1. Waveform for inverting Outputs

NOTE:  $V_M = 1.3\text{V}$  for 54LS/S;  $V_M = 1.5\text{V}$  for all other TTL families.

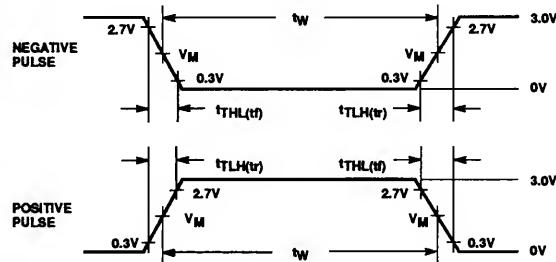
## Gates

## 5400, 54LS00, 54S00

## TEST CIRCUIT AND WAVEFORM



Test Circuit for 54 Totem-Pole Outputs



Input Pulse Definition

FAMILY	INPUT PULSE CHARACTERISTICS					
	R <sub>L</sub>	V <sub>M</sub>	Rep. Rate	t <sub>W</sub>	t <sub>TLH</sub>	t <sub>THL</sub>
54LSXXX	2.0kΩ	1.3V	1MHz	500ns	≤15ns	≤6ns
54XXX	400Ω	1.5V	1MHz	500ns	≤7ns	≤7ns
54SXXX	280Ω	1.5V	1MHz	500ns	≤2.5ns	≤2.5ns

## DEFINITIONS:

C<sub>L</sub> = Load capacitance includes jig and probe capacitance; see AC Characteristics for value.

R<sub>T</sub> = Termination resistance should be equal to Z<sub>out</sub> of Pulse Generators.

D = Diodes are 1N916, 1N3064, or equivalent.

V<sub>X</sub> = Unclocked pins must be held at ≤0.8V, ≥2.7V or open per Function Table.